The purpose of this spreadsheet is to derive Acceptable Tissue Levels (ATLs; also known as Target Tissue Co (SLVs) for DDx compounds for use in Portland Harbor that would be protective of birds that eat fish, and to Assessment (BERA) . Two approaches were used to derive the SLVs and ATLs; the dietary approach and the Another purpose is to identify any mathematical errors and discrepancies in the calculations used to deterr occurred, and to determine if a better TRV can be established for DDx compounds.

The spreadsheet compares various risk parameters used by LWG in the 2011 BERA to values 1) recommend within EPA's EcoSSL document for DDT (EPA 2007) and 4) the EPA (1995) Great Lakes Initiative document.

The SLVs are presented in the "SLVs_Compared" tab, and TRVs and ATLs are compared in the "Eco TRVs + and body weights from multiple sources, and re-calculates TRVs based on these values. SLVs were calculat appropriate column (i.e., to evaluate sensitivity of the BSAF value) will automatically update the SLV value

This spreadsheet shows that the dietary SLVs and ATLs vary greatly depended on the TRV selected for evalu these TRV values, especially those over 1 ppm in fish, would not be considered protective of fish themselve to 87 from fish to bird egg (see text box adjacent to the ATL columns for a list of values considered protecti are very low and approach detection limits, and may be overprotective for some species.

Some discrepancies were observed in calculations between LWG and EcoSSLs, which can be seen in the "IR used to calculate TRVs account for some discrepancies (e.g., slight body weight difference results in large T dry and wet weight doses and ingestion rates. The values calculated here were conducted by matching dry cases it was unknown or unreported in the literature if a dose was dry or weight, but in these cases the stu have made little difference in the outcome.

The final yellow highlighted row under each species in the "SLVs_Compared" tab and the "Eco TRVs + ATLs provide the best scientifically-supported level of protection for upper trophic level species to DDE and DDT some species exceeds ATL values that are considered protective of fish, and no uncertainty or safety factor toxicity values are unavailable, or for sensitive species or guilds).

ncentrations (TTCs) or Target Tissue Levels (TTLs), and Sediment Screening Levels
evaluate or double check specific parameters used in the Baseline Ecological Risk
e egg approach, which are discussed in the notes section of the "SLVs_Compared" tab.
mine Toxicity Reference Values (TRVs), identify why these discrepancies may have

ed previously by EPA, 2) are in Oregon DEQ's bioaccumulation guidance, 3) that are

ATLs". The "IRs&BodyWtComparisons" sheet presents and compares ingestion rates
ted using a generic BSAF for DDx compounds of 4. Changing the BSAF in the
s presented in the "SLVs_compared tab".

uation (see yellow highlighted ATL columns in the "Eco TRVs + ATLs" tab). Some of
es or of fish-eating birds, which typically have biomagnification factors ranging from 22
ive of fish from other evaluations). In contrast, the SLVs based on the egg approach

s&BodyWtComparisons" tab. Some differences in ingestion rates and body weights
RV differences), and other differences were associated with interpreting or converting
weight doses to dry weight IRs, and wet weight doses to wet weight IRs. In some
dy used lab prepared food which had 10% or less moisture, so any conversions would

" tab shows the recommended value by US Fish and Wildlife Service (FWS) that would
. It should be noted that even the recommended value for the dietary approach for
s were used in the equations (often used in to better protect species were direct

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shington, DC.

SLV= Value in sediment (µg/kg dry weight) considered protective of avian receptors a

	EGG APPROACH		EGG APPROACH		DIETARY APPROACH		DIETARY A
	Bald Eagle		Osprey		Bald Eagle		Osp
	Individual	Population	Individual	Population	Individual	Population	Individual
DDT							
LWG	ND	ND	ND	ND	53	525	30
Gov Team	ND	ND	ND	ND			
FWS selected	ND	ND	ND	ND	69	694	40
DDE							
LWG					27	74	16
Gov Team					28	49	16
FWS selected	1	2	1	3	13	65	7

ND = not determined

Final recommended value by FWS

Notes:

EGG APPROACH:

The egg approach was selected as a risk evaluation tool because the primary moc
on concentrations in eggs, eggshell thickness measurements, and embryo mortali
the dietary approach and shell thinning. Eggshell thinning and embryo mortality
reason, eggshell thinning was selected as the primarily endpoint when evaluating
effects from DDE. It should be noted that eggshell thinning has been observed in
on eggshell thinning.

The bald eagle was the receptor selected to represent protective values based on
between increased DDE in eggs and lowered productivity based on field data for l
ducks, fish-eating birds, some mammals, and also scavenge when opportunity is a
season, whereas they relied a bit more on waterfowl during the non-breeding sea
during the month before nesting and egg laying. Because fish are fed on heavily c
prior to egg laying, as well as to the DDE burden in the eggs themselves.

Using the SLV based on bald eagles should be protective of most other fish-eating
considered important in a risk evaluation. The eagle's primarily foraging range du
be considered when evaluating risk using the SLVs.

There is no value selected for DDT and protection of eggs using the egg approach
protective of fish-eating birds, values of DDE should be used to also represent DD
the DDE screening value).

DIETARY APPROACH:

Dietary exposure to DDT can cause mortality and other effects, and DDT can prod
mortality. The avian TRV used to evaluate multiple avian receptors was based on
exposure. Thus, the sediment values are considered protective of mortality of kir
home range, is more of an obligate fish-eater compared to other species, and is n
protective of mortality for most other fish-eating bird species, and it is likely that

Dietary exposure to DDE can cause eggshell thinning, and risk to DDE using the d
screening value for DDE (3 and 16 ppb) was based on kingfisher exposure. Thus, t
selected as the best representative species for Portland Harbor because it has a s
Kelly et al. 2009). Therefore, protection at the kingfisher level would most likely b

at the individual and population levels (based on BSAF of 4)

APPROACH	DIETARY APPROACH		DIETARY APPROACH		DIETARY APPROACH	
rey	Spotted Sandpiper		Hooded merganser		Kingfisher	
Population	Individual	Population	Individual	Population	Individual	Population
300	8	76	17	170	13	126
397	10	101	23	225	17	167
42	4	11	9	24	7	18
28	4	7	9	16	7	12
37	2	9	4	21	3	16

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de of action for DDE is eggshell thinning, and egg approach directly evaluates this risk (i.e., data are directly avai
ity). The dietary approach only indirectly addresses this risk, and data are less available for fish-eating birds bas
will occur at low DDE concentrations (i.e., at concentrations that may otherwise not impact the adult bird). Fo
risk for DDE, and selecting a PRG value protective of eggshell thinning will mostly likely be protective of all oth
birds dosed with DDT or PCBs and other chemicals, but DDE has the most dramatic, consistent, and significant

the egg approach. The eagle was selected to represent resident, fish-eating birds, and there is good correlatio
bald eagles. There is some uncertainty in this approach, as bald eagles do eat other prey in addition to fish (inc
available). However, bald eagles studied in the lower Columbia River fed primarily on fish (90%) during the bre
ason. For our risk model, we consider DDE to be accumulated in the adult female's body over time and especia
during the breeding season, fish likely contribute a large portion of the DDE body burdens in the adult female ju

birds. However, the foraging range of an eagle is large compared to other birds and the larger range may be
uring the breeding season is considered to be within 1 mile of a nest site. Therefore, some level of site use fact

. However, DDT and DDD metabolism in the environment can produce DDE, so it is recommended that to be
T (or, a total DDT value could be derived based on p,p-DDT plus p,p-DDE plus p,p-DDD in sediment and compa

duce DDE metabolites which can impact eggshell thinning. For the dietary approach, risk from DDT was based o
eagle mortality. The recommended sediment screening value for DDT (17 and 167 ppb) was based on kingfish
ngfishers. The kingfisher was selected as the best representative species for Portland Harbor because it has a s
non-migratory in this area (see Kelly et al. 2009). Therefore, protection at the kingfisher level would most likely
a site use factor would not be needed to fully represent risk.

ietary approach was based on and avian TRV causing eggshell thinning in mallards. The recommended sedimer
the sediment screening values are considered protective of eggshell thinning in kingfishers. The kingfisher was
mall home range, is more of an obligate fish-eater compared to other species, and is non-migratory in this area
be protective of mortality for most other fish-eating bird species, and it is likely that a site use factor would not

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Equations used to calculate Acceptable Tissue Levels (ATLs) in prey items and NOAEL and LOAEL TRVs

Calculation ATL's from TRV's (IRs in kg F

ATL = TRV (mg/kg BW-day) / (IR kg-ww-day/ BW)
mg/kg (wet weight)

Calculating ATL's when IRs are in units of kg/kg BW-day

ATL = TRV (mg/kg BW-day) / (IR kg/kg-ww-day)
mg/kg (wet weight)

Calculation of TRVs

NOAEL TRV = NOAEL (mg/kg ww)*IR (kg-ww-d) / BW (kg)
(mg/kg-d)

LOAEL TRV = LOAEL(mg/kg ww)*IR (kg-ww-d) / BW (kg)
(mg/kg-d)

or NOAEL (mg/kg ww)*IR (kg/kg-d)

or LOAEL (mg/kg ww)*IR (kg/kg-d)

Calculation of Sediment Bioaccumulation SLVs

SLVs for Organics

SLV = Foc * ATL / (BSAF * FL)   Equation 3-5 (DEQ 2002)
mg/kg (wet weight)

Fl = 0.09 unitless (whole body)
Foc = 0.01
These parameters are updatable based on site-specific analyses

FL = Fraction Lipid in Fish or other organism Tissue-default = 0.09 whole body unitless
Foc = Fraction Organic Carbon in sediment-default = 0.01 unitless
BSAF = Biota-Sediment Accumulation Factor (kg/kg)
ATL = Acceptable Tissue Level from ATL worksheets (mg/kg-wet)
SLV = Sediment Screening Level Value

$$BSAF = \frac{C_{fish}\ (\mu g/Kg\ wet\ wt) / F_L\ (g\ L\ per\ g/wet\ wt)}{C_{sed}\ (\mu g/Kg\ dry\ wt) / F_{oc}\ (g\ org\ carb/g\ dry\ wt)}$$

Cfish = contaminant concentration in fish, wet weight
Csed = contaminant concentration in sediment, dry weight
Foc = organic carbon fraction in sediment, dry weight, default = 0.01
FL = lipid fraction in fish, wet weight, default = 0.09 whole body

EGG APPROACH: Calculating ATL's from TRV's

ATL = TRV / BMF
mg/kg (wet wei

ATL = acceptable tissue level (mg/kg) wet wt
TRV = toxicity reference value (mg/kg) from literature wet wt
BMF = biomagnification factor (unitless) from literature

Parameters based on LWG BERA, 2011

DIETARY APPROACH

Endpoint species parameters / Surrogate Test Species Parameters

	Bald Eagle	Bald Eagle LWG	Osprey	Osprey LWG	Spotted Sandpiper BSE	Spotted Sandpiper LWG	Hooded Merganser LWG	Belted Kingfisher BSE	Belted Kingfisher LWG	Pelican EPA 1995	Kestrel EPA 1995	Kestrel LWG	Barn Owl EPA 19	Barn Owl LWG	Black Duck (EcoS	Black Duck LWG	Mallard (EcoSSL	Mallard LWG	Mallard LWG EcoSSL & Carlisle et al.
IR kg/day wet wt	0.54	0.54	0.305	0.4	0.039	0.055	0.2	0.5	0.08	0.62	[illegible]	[illegible]	0.100	[illegible]	[illegible]	0.125	[illegible]	0.1082	[illegible]
IR kg/day dry wt	NA								0.017	[illegible]		[illegible]		[illegible]					[illegible]
IR kg/kg-day wet wt								0.5			[illegible]				[illegible]		[illegible]		
IR kg/kg-day dry weight																	[illegible]		
BW (kg)	4.5	4.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
LOAEL mg/kg wet wt unless otherwise noted in field comments	10									[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NOAEL mg/kg wet wt	3									NA	[illegible]	[illegible]					[illegible]		[illegible]

TABLE 1

Endpoint Species: Bald Eagle	Chemical	Estimate of Eagle Individual NOAEL TRV (mg/kg-d)	Surrogate Test Species used for NOAEL TRV	Surrogate Test Endpoints associated with effect levels	Surrogate TRV reference	Estimate of Eagle Population LOAEL TRV(mg/kg-d)	Surrogate Test Species used for LOAEL TRV	Surrogate Test Endpoints associated with effect levels	reference	ATL calculation using endpoint species BW&IR: Eagle Individual ATL (Wet Wt.) (ppm)	Eagle Population ATL (Wet Wt.) (ppm)	Comments	BSAF (used for organics) kg/kg	Sediment SLV Calculations - PPB DRY WT: Eagle Individual SLV - µg/kg Dry Wt (ppb)	Eagle Population SLV - µg/kg Dry Wt (ppb)
DDT estimates:															
Used by DEQ in Bioaccumulation G	Total DDTs	0.009	Pelican (field study)	LOAEL divided by 3, stand	Anderson et al 1975 as	0.027	Pelican (field study)	Reproductive success	Anderson et al 1975 as	0.07	0.22		4	2	6
LWG used for DDT as directed by EP	Total DDTs	0.227	Chicken: Avian TRV	Growth selected after revie	Cecil et al. 1978, EcoS	2.27	Chicken: LOAEL from same study	Based on Growth afte	Cecil et al. 1978 LWG l	1.89	18.9		4	53	525
Dose causing mortality in eagles	DDT	0.30	Bald Eagle	Mortality (no IR reported in	Chura and Stewart (19	3.00	Bald eagle	Mortality (no IR report	Chura and Stewart (19	2.50	25.0	Concentration in fish	4	69	694
DDE Estimates															
LWG estimated value (Kestrels)	DDE	0.12	Kestrel	Eggshell thinning, wild ca	Lincer 1975, Using Eco	1.2	Kestrel	Eggshell thinning, wil	Lincer 1975. Based on	0.99	9.85		4	27	274
LWG estimated value (Mallards)	DDE	NR				0.90	Mallard	DDE exposure, 2 year	Heath et al. 1969 as cit	NR	7.50		4	NC	208
EWS estimated value (Mallards with	DDE (DDT NOAEL)	0.12	Mallard	Based on DDT for NOAEL	Davison and Sell (1974	0.60	Mallard	DDE exposure, 2 year	Heath et al. 1969 as cit	1.00	5.00		4	28	139
EWS estimated value (Mallards from	DDE	0.06	Mallard	Eggshell thinning, Eggsh	Carlisle et al. 1986	0.28	Mallard	Eggshell thinning, Eg	Carlisle et al. 1986	0.47	2.35		4	13	65
LWG estimated value (Black ducks)	DDE	NR				0.90	Black duck	DDE exposure, eggsh	Longcore et al. 1971	NR	7.50		4	NC	208
EWS estimated value (Black ducks	DDE	NR				0.55	Black duck	DDE exposure, eggsh	Longcore et al. 1971	NR	4.55		4	NC	126
EWS estimate using ww ingestion rat	DDE	0.11	Barn owl	TRV based on LOAEL of a	Mendenhall (1983) EWS	0.54	Barn owl	Reproductive success	Mendenhall (1983) EWS	0.90	4.50		4	25	125
LWG estimate using dw ingestion rat	DDE	NR				0.32	Barn owl	Reproductive success	Mendenhall (1983) LWG	NR	2.66		4	NC	74
Selected or Recommended values:															
LWG used in BERA for DDE	DDE	0.12	Kestrel	Eggshell thinning, wild ca	Lincer 1975, Based on	0.32	Barn owl	Reproductive success	Mendenhall (1983) LWG	0.99	2.66		4	27	74
LWG used for DDT as directed by EP	Total DDT	0.227	Chicken: Avian TRV	Growth selected after revie	Cecil et al. 1978 EcoSS	2.27	2.27	Chicken: LOAEL from	Cecil et al. 1978 Based	1.89	18.9		4	53	525
Gov Team Recommendation	DDX	0.12	Kestrel	Eggshell thinning, wild ca	Lincer 1975 (Gov team	0.211	Barn owl	Reproductive success	Mendenhall (1983) EPA	1.00	1.76		4	28	49
Recalculated Gov Team Rec with new LOAEL						0.201	Barn owl	Reproductive success	Mendenhall (1983) valu	NC	1.68		4	NC	47
Revised EWS recommendation	DDE or DDX	0.06	Mallard	Eggshell thinning, Eggsh	Carlisle et al. 1986	0.28	Mallard	Eggshell thinning, Eg	Carlisle et al. 1986	0.47	2.35	More protective of	4	13	65

Value in EcoSSL appears to be incorrect (no next worksheet) and should be 0.201 mg/kg/day, resulting in an ATL of 1 and 1.68. However, this value is likely wrong anyway as they did not convert the dose to dry wt beforehand (in they used a ww dose times a dw IR to get 0.211).

Acceptable fish tissue value comparison:

0.7 mg DDT/kg wet wt = ATL in salmon tissue, above which effects would be expected (Beckvar et al. 2005).
0.04 mg DDE/kg wet = ATL in fish tissue protective of bald eagles in the lower Columbia River (US Fish and wildlife Service 2004) based on a egg BMF of 85 and a NO- or LOAEL level in bald eagle eggs of 3.5 mg/kg ww. (Note: ATL would be 0.06 mg DDE/kg if we used the less conservative estimated NOAEL of 5.0 mg DDE/kg)
0.05 mg DDE/kg wet wt = ATL in fish tissue considered protective of ospreys in the Willamette River (Henny et al. 2003.) based on a BMF or 87 and a NO- or LOAEL in osprey eggs of 4.2 mg/kg ww.
0.054 mg DDE/kg wet wt = CTL in fish estimated by DEQ Bioaccum Giuidance based on tthe National Recommended WQC of 0.001 ug/L and BCF of 54,000 l/kg.
0.051 DDE / kg wet wt = ATL is fish tissue (NOAEL) and 0.15 DDE / kg wet wt (LOAEL) estimated by DEQ Bioaccumulation guidance.
0.16 mg DDE/kg wet wt as level in fish that would have no effect on eagle eggs in the Great Lakes ; BMF of 22 and eagle egg NOAEC of 3.5 mg/kg ww (Giesy et al. 1995).

TABLE 2

Endpoint Species: Osprey	Chemical	Estimate of Osprey Individual NOAEL TRV (mg/kg-d)	Surrogate Test Species used for NOAEL TRV	Surrogate Test Endpoints associated with effect levels	Surrogate TRV reference	Estimate of Osprey Population LOAEL TRV (mg/kg-d)	Surrogate Test Species used for LOAEL TRV	Surrogate Test Endpoints associated with effect levels	reference	ATL calculation using endpoint species BW&IR: Osprey Individual ATL (Wet Wt.) (ppm)	Osprey Population ATL (Wet Wt.) (ppm)	BSAF (used for organics) kg/kg	Sediment SLV Calculations - PPB DRY WT: Osprey Individual SLV - µg/kg Dry Wt (ppb)	Osprey Population SLV - µg/kg Dry Wt. (ppb)
DDT estimates:														
Used by DEQ in Bioaccumulation G	Total DDTs	0.009	Pelican	Reproductive success, fled	Anderson et al 1975 as	0.03	Pelican	Reproductive success	Anderson et al 1975 as	0.04	0.13	4	1	4
LWG used for DDT as directed by EP	Total DDTs	0.227	Chicken: Avian TRV	Growth selected after revie	Cecil et al. 1978, EcoS	2.27	Chicken: LOAEL from same study	Based on Growth afte	Cecil et al. 1978 LWG l	1.08	10.80	4	30	300
Dose causing mortality in eagles	DDT	0.30	Bald Eagle	Mortality (no IR reported in	Chura and Stewart (19	3.00	Bald eagle	Mortality (no IR report	Chura and Stewart (19	1.43	14.28	4	40	397
DDE Estimates														
LWG estimated value (Kestrels)	DDE	0.12	Kestrel	Eggshell thinning, wild ca	Lincer 1975, Using Eco	1.2	Kestrel	Eggshell thinning, wil	Lincer 1975. Based on	0.56	5.63	4	16	156
LWG estimated value (Mallards)	DDE	NR				0.90	Mallard	DDE exposure, 2 year	Heath et al. 1969 as cited in EPA 1995 and EcoSSL		4.28	4	0	119
EWS estimated value (Mallards with	DDE (DDT NOAEL)	0.12	Mallard	Based on DDT for NOAEL	Davison and Sell (1974	0.60	Mallard	DDE exposure, 2 year	Heath et al. 1969 as cit	0.57	2.86	4	16	79
EWS estimated value (Mallards from	DDE	0.06	Mallard	Eggshell thinning, Eggsh	Carlisle et al. 1986	0.28	Mallard	Eggshell thinning, Eg	Carlisle et al. 1986	0.27	1.34	4	7	37
LWG estimated value (Black ducks)	DDE	NR				0.90	Black duck	DDE exposure, eggsh	Longcore et al. 1971		4.28	4	NC	119
EWS estimated value (Black ducks	DDE	NR				0.55	Black duck	DDE exposure, eggsh	Longcore et al. 1971		2.60	4	NC	72
EWS estimate using ww ingestion rat	DDE	0.11	Barn owl	TRV based on LOAEL of a	Mendenhall (1983) EWS	0.54	Barn owl	Reproductive success	Mendenhall (1983) EWS	0.51	2.57	4	14	71
LWG estimate using dw ingestion rat	DDE	NR				0.32	Barn owl	Reproductive success	Mendenhall (1983) LWG interpretation		1.52	4	NC	42
Selected or Recommended values:												4		
LWG used in BERA for DDE	DDE	0.12	Kestrel	Eggshell thinning, wild ca	Lincer 1975, Based on	0.32	Barn owl	Reproductive success	Mendenhall (1983) LWG	0.56	1.52	4	16	42
LWG used for DDT as directed by EP	Total DDT	0.227	Chicken: Avian TRV	Growth selected after revie	Cecil et al. 1978 EcoSS	2.27	2.27	Chicken: LOAEL from	Cecil et al. 1978 Based	1.08	10.80	4	30	300
Gov Team Recommendation	DDX	0.12	Kestrel	Eggshell thinning, wild ca	Lincer 1975 (Gov team	0.211	Barn owl	Reproductive success	Mendenhall (1983) EPA	0.57	1.00	4	16	28
Recalculated Gov Team Rec with new LOAEL						0.201	Barn owl	Reproductive success	Mendenhall (1983) valu	NC	0.96	4	NC	27
Revised EWS recommendation	DDE or DDX	0.06	Mallard	Eggshell thinning, Eggsh	Carlisle et al. 1986	0.28	Mallard	Eggshell thinning, Eg	Carlisle et al. 1986	0.27	1.34	4	7	37

Value in EcoSSL appears to be incorrect (no next worksheet) and should be 0.201 mg/kg/day, resulting in an ATL of 1 and 1.68. However, this value is likely wrong anyway as they did not convert the dose to dry wt beforehand (in they used a ww dose times a dw IR to get 0.211).

TABLE 3

Endpoint Species: Spotted Sandpiper	Chemical	Estimate of Spotted Sandpiper Individual NOAEL TRV (mg/kg-d)	Surrogate used for NOAEL TRV	Surrogate Endpoints associated with effect levels	Surrogate TRV reference	Estimate of Spotted Sandpiper Population LOAEL TRV (mg/kg-d)	Surrogate used for LOAEL TRV	Surrogate Endpoints associated with effect levels	reference	ATL calculation using endpoint species BW&IR: Spotted Sandpiper Individual ATL (Wet Wt.) (ppm)	Spotted Sandpiper Population ATL (Wet Wt.) (ppm)	BSAF (used for organics) kg/kg	Sediment SLV Calculations - PPB DRY WT: Sandpiper Individual SLV - µg/kg Dry Wt (ppb)	Sandpiper Population SLV - µg/kg Dry Wt. (ppb)
DDT estimates:														
Used by DEQ in Bioaccumulation G	Total DDTs	0.009	Pelican	Reproductive success, fled	Anderson et al 1975 as	0.03	Pelican	Reproductive success	Anderson et al 1975 as	0.01	0.03	4	0.3	1
LWG used for DDT as directed by EP	Total DDTs	0.227	Chicken: Avian TRV	Growth selected after revie	Cecil et al. 1978, EcoS	2.27	Chicken: LOAEL from same study	Based on Growth afte	Cecil et al. 1978 LWG l	0.27	2.74	4	8	76
Dose causing mortality in eagles	DDT	0.30	Bald Eagle	Mortality (no IR reported in	Chura and Stewart (19	3.00	Bald eagle	Mortality (no IR report	Chura and Stewart (19	0.36	3.62	4	10	101
DDE Estimates														
LWG estimated value (Kestrels)	DDE	0.12	Kestrel	Eggshell thinning, wild ca	Lincer 1975, Using Eco	1.2	Kestrel	Eggshell thinning, wil	Lincer 1975. Based on	0.14	1.43	4	4	40
LWG estimated value (Mallards)	DDE	NR				0.90	Mallard	DDE exposure, 2 year	Heath et al. 1969 as cited in EPA 1995 and EcoSSL		1.09	4	0	30
EWS estimated value (Mallards with	DDE (DDT NOAEL)	0.12	Mallard	Based on DDT for NOAEL	Davison and Sell (1974	0.60	Mallard	DDE exposure, 2 year	Heath et al. 1969 as cit	0.14	0.72	4	4	20
EWS estimated value (Mallards from	DDE	0.06	Mallard	Eggshell thinning, Eggsh	Carlisle et al. 1986	0.28	Mallard	Eggshell thinning, Eg	Carlisle et al. 1986	0.07	0.34	4	2	9
LWG estimated value (Black ducks)	DDE	NR				0.90	Black duck	DDE exposure, eggsh	Longcore et al. 1971		1.09	4	NC	30
EWS estimated value (Black ducks	DDE	NR				0.55	Black duck	DDE exposure, eggsh	Longcore et al. 1971		0.66	4	NC	18
EWS estimate using ww ingestion rat	DDE	0.11	Barn owl	TRV based on LOAEL of a	Mendenhall (1983) EWS	0.54	Barn owl	Reproductive success	Mendenhall (1983) EWS	0.13	0.65	4	4	18
LWG estimate using dw ingestion rat	DDE	NR				0.32	Barn owl	Reproductive success	Mendenhall (1983) LWG interpretation		0.39	4	NC	11
Selected or Recommended values:												4		
LWG used in BERA for DDE	DDE	0.12	Kestrel	Eggshell thinning, wild ca	Lincer 1975, Based on	0.32	Barn owl	Reproductive success	Mendenhall (1983) LWG	0.14	0.39	4	4	11
LWG used for DDT as directed by EP	Total DDT	0.227	Chicken: Avian TRV	Growth selected after revie	Cecil et al. 1978 EcoSS	2.27	2.27	Chicken: LOAEL from	Cecil et al. 1978 Based	0.27	2.74	4	8	76
Gov Team Recommendation	DDX	0.12	Kestrel	Eggshell thinning, wild ca	Lincer 1975 (Gov team	0.211	Barn owl	Reproductive success	Mendenhall (1983) EPA	0.14	0.25	4	4	7
Recalculated Gov Team Rec with new LOAEL						0.201	Barn owl	Reproductive success	Mendenhall (1983) valu	NC	0.24	4	NC	7
Revised EWS recommendation	DDE or DDX	0.06	Mallard	Eggshell thinning, Eggsh	Carlisle et al. 1986	0.28	Mallard	Eggshell thinning, Eg	Carlisle et al. 1986	0.07	0.34	4	2	9

Value in EcoSSL appears to be incorrect (no next worksheet) and should be 0.201 mg/kg/day, resulting in an ATL of 1 and 1.68. However, this value is likely wrong anyway as they did not convert the dose to dry wt beforehand (in they used a ww dose times a dw IR to get 0.211).

TABLE 4

Endpoint Species: Hooded Merganser	Chemical	Estimate of Hooded merganser individual NOAEL TRV (mg/kg-d)	Surrogate used for NOAEL TRV	Surrogate Endpoints associated with effect levels	Surrogate TRV reference	Estimate of Hooded merganser Population LOAEL TRV (mg/kg-d)	Surrogate used for LOAEL TRV	Surrogate Endpoints associated with effect levels	reference	ATL calculation using endpoint species BW&IR: Hooded merganser Individual ATL (Wet Wt.) (ppm)	Hooded merganser Population ATL (Wet Wt.) (ppm)	BSAF (used for organics) kg/kg	Sediment SLV Calculations - PPB DRY WT: merganser Individual SLV - µg/kg Dry Wt (ppb)	merganser Population SLV - µg/kg Dry Wt. (ppb)
DDT estimates:														
Used by DEQ in Bioaccumulation G	Total DDTs	0.009	Pelican	Reproductive success, fled	Anderson et al 1975 as	0.03	Pelican	Reproductive success	Anderson et al 1975 as	0.02	0.07	4	0.7	2
LWG used for DDT as directed by EP	Total DDTs	0.227	Chicken: Avian TRV	Growth selected after revie	Cecil et al. 1978, EcoS	2.27	Chicken: LOAEL from same study	Based on Growth afte	Cecil et al. 1978 LWG l	0.61	6.13	4	17	170
Dose causing mortality in eagles	DDT	0.30	Bald Eagle	Mortality (no IR reported in	Chura and Stewart (19	3.00	Bald eagle	Mortality (no IR report	Chura and Stewart (19	0.81	8.10	4	22	225
DDE Estimates														
LWG estimated value (Kestrels)	DDE	0.12	Kestrel	Eggshell thinning, wild ca	Lincer 1975, Using Eco	1.2	Kestrel	Eggshell thinning, wil	Lincer 1975. Based on	0.32	3.19	4	9	89
LWG estimated value (Mallards)	DDE	NR				0.90	Mallard	DDE exposure, 2 year	Heath et al. 1969 as cit	NC	2.43	4	#VALUE!	68
EWS estimated value (Mallards with	DDE (DDT NOAEL)	0.12	Mallard	Based on DDT for NOAEL	Davison and Sell (1974	0.60	Mallard	DDE exposure, 2 year	Heath et al. 1969 as cit	0.32	1.62	4	9	45
EWS estimated value (Mallards from	DDE	0.06	Mallard	Eggshell thinning, Eggsh	Carlisle et al. 1986	0.28	Mallard	Eggshell thinning, Eg	Carlisle et al. 1986	0.15	0.76	4	4	21
LWG estimated value (Black ducks)	DDE	NR				0.90	Black duck	DDE exposure, eggsh	Longcore et al. 1971	NC	2.43	4	NC	68
EWS estimated value (Black ducks	DDE	NR				0.55	Black duck	DDE exposure, eggsh	Longcore et al. 1971	NC	1.47	4	NC	41
EWS estimate using ww ingestion rat	DDE	0.11	Barn owl	TRV based on LOAEL of a	Mendenhall (1983) EWS	0.54	Barn owl	Reproductive success	Mendenhall (1983) EWS	0.29	1.46	4	8	41
LWG estimate using dw ingestion rat	DDE	NR				0.32	Barn owl	Reproductive success	Mendenhall (1983) LWG	NC	0.86	4	NC	24
Selected or Recommended values:												4		
LWG used in BERA for DDE	DDE	0.12	Kestrel	Eggshell thinning, wild ca	Lincer 1975, Based on	0.32	Barn owl	Reproductive success	Mendenhall (1983) LWG	0.32	0.86	4	9	24
LWG used for DDT as directed by EP	Total DDT	0.227	Chicken: Avian TRV	Growth selected after revie	Cecil et al. 1978 EcoSS	2.27	2.27	Chicken: LOAEL from	Cecil et al. 1978 Based	0.61	6.13	4	17	170
Gov Team Recommendation	DDX	0.12	Kestrel	Eggshell thinning, wild ca	Lincer 1975 (Gov team	0.211	Barn owl	Reproductive success	Mendenhall (1983) EPA	0.32	0.57	4	9	16
Recalculated Gov Team Rec with new LOAEL						0.201	Barn owl	Reproductive success	Mendenhall (1983) valu	NC	0.54	4	NC	15
Revised EWS recommendation	DDE or DDX	0.06	Mallard	Eggshell thinning, Eggsh	Carlisle et al. 1986	0.28	Mallard	Eggshell thinning, Eg	Carlisle et al. 1986	0.15	0.76	4	4	21

Value in EcoSSL appears to be incorrect (no next worksheet) and should be 0.201 mg/kg/day, resulting in an ATL of 1 and 1.68. However, this value is likely wrong anyway as they did not convert the dose to dry wt beforehand (in they used a ww dose times a dw IR to get 0.211).

TABLE 5

Endpoint Species: Belted Kingfisher	Chemical	Estimate of belted kingfisher individual NOAEL TRV (mg/kg-d)	Surrogate used for NOAEL TRV	Surrogate Endpoints associated with effect levels	Surrogate TRV reference	Estimate of belted kingfisher Population LOAEL TRV (mg/kg-d)	Surrogate used for LOAEL TRV	Surrogate Endpoints associated with effect levels	reference	LWG Test Parameters (IR and BW of kingfisher): LWG Ingestion rate for belted kingfisher Individual ATL (Wet Wt.) (ppm)	LWG ingestion rate for belted kingfisher Population ATL (Wet Wt.) (ppm)	RSET/EPA parameters kingfisher: EPA 1993 from Alexander 1977 belted kingfisher Individual ATL (Wet Wt.) (ppm)	EPA 1993 from Alexander 1977 belted kingfisher Population ATL (Wet Wt.) (ppm)	BSAF (used for organics) kg/kg	Sediment SLV Calculations - PPB DRY WT: belted kingfisher Individual SLV - µg/kg Dry Wt (ppb)	belted kingfisher Population SLV - µg/kg Dry Wt. (ppb)
DDT estimates:																
Used by DEQ in Bioaccumulation G	Total DDTs	0.009	Pelican	Reproductive success, fled	Anderson et al 1975 as	0.03	Pelican	Reproductive success	Anderson et al 1975 as	0.02	0.05	0.02	0.05	4	0.5	1
LWG used for DDT as directed by EP	Total DDTs	0.227	Chicken: Avian TRV	Growth selected after revie	Cecil et al. 1978, EcoS	2.27	Chicken: LOAEL from same study	Based on Growth afte	Cecil et al. 1978 LWG l	0.42	4.17	0.45	4.54	4	12.6	126
Dose causing mortality in eagles	DDT	0.30	Bald Eagle	Mortality (no IR reported in	Chura and Stewart (19	3.00	Bald eagle	Mortality (no IR report	Chura and Stewart (19	0.55	5.51	0.60	6.00	4	16.7	167
DDE Estimates																
LWG estimated value (Kestrels)	DDE	0.12	Kestrel	Eggshell thinning, wild ca	Lincer 1975, Using Eco	1.2	Kestrel	Eggshell thinning, wil	Lincer 1975. Based on	0.22	2.17	0.24	2.36	4	6.6	66
LWG estimated value (Mallards)	DDE	NR				0.90	Mallard	DDE exposure, 2 year	Heath et al. 1969 as cited in EPA 1995 and EcoSSL		1.65		1.80	4	0.0	50
EWS estimated value (Mallards with	DDE (DDT NOAEL)	0.12	Mallard	Based on DDT for NOAEL	Davison and Sell (1974	0.60	Mallard	DDE exposure, 2 year	Heath et al. 1969 as cit	0.22	1.10	0.24	1.20	4	6.7	33
EWS estimated value (Mallards from	DDE	0.06	Mallard	Eggshell thinning, Eggsh	Carlisle et al. 1986	0.28	Mallard	Eggshell thinning, Eg	Carlisle et al. 1986	0.10	0.52	0.11	0.56	4	3.1	16
LWG estimated value (Black ducks)	DDE	NR				0.90	Black duck	DDE exposure, eggsh	Longcore et al. 1971		1.65		1.80	4	NC	50
EWS estimated value (Black ducks	DDE	NR				0.55	Black duck	DDE exposure, eggsh	Longcore et al. 1971		1.00		1.09	4	NC	30
EWS estimate using ww ingestion rat	DDE	0.11	Barn owl	TRV based on LOAEL of a	Mendenhall (1983) EWS	0.54	Barn owl	Reproductive success	Mendenhall (1983) EWS	0.20	0.99	0.22	1.08	4	6.0	30
LWG estimate using dw ingestion rat	DDE	NR				0.32	Barn owl	Reproductive success	Mendenhall (1983) LWG interpretation		0.59		0.64	4	NC	18
Selected or Recommended values:														4		
LWG used in BERA for DDE	DDE	0.12	Kestrel	Eggshell thinning, wild ca	Lincer 1975, Based on	0.32	Barn owl	Reproductive success	Mendenhall (1983) LWG	0.22	0.59	0.24	0.64	4	6.6	18
LWG used for DDT as directed by EP	Total DDT	0.227	Chicken: Avian TRV	Growth selected after revie	Cecil et al. 1978 EcoSS	2.27	2.27	Chicken: LOAEL from	Cecil et al. 1978 Based	0.42	4.17	0.45	4.54	4	12.6	126
Gov Team Recommendation	DDX	0.12	Kestrel	Eggshell thinning, wild ca	Lincer 1975 (Gov team	0.211	Barn owl	Reproductive success	Mendenhall (1983) EPA	0.22	0.39	0.24	0.42	4	6.7	12
Recalculated Gov Team Rec with new LOAEL						0.201	Barn owl	Reproductive success	Mendenhall (1983) valu	NC	0.37		0.40	4	NC	11
Revised EWS recommendation	DDE or DDX	0.06	Mallard	Eggshell thinning, Eggsh	Carlisle et al. 1986	0.28	Mallard	Eggshell thinning, Eg	Carlisle et al. 1986	0.10	0.52	0.11	0.56	4	3.1	16

Value in EcoSSL appears to be incorrect (no next worksheet) and should be 0.201 mg/kg/day, resulting in an ATL of 1 and 1.68. However, this value is likely wrong anyway as they did not convert the dose to dry wt beforehand (in they used a ww dose times a dw IR to get 0.211).

Acceptable fish tissue value comparison:

0.7 mg DDT/kg wet wt = ATL in salmon tissue, above which effects would be expected (Beckvar et al. 2005).
0.04 mg DDE/kg wet = ATL in fish tissue protective of bald eagles in the lower Columbia River (US Fish and wildlife Service 2004) based on a egg BMF of 85 and a NO- or LOAEL level in bald eagle eggs of 3.5 mg/kg ww. (Note: ATL would be 0.06 mg DDE/kg if we used the less conservative estimated NOAEL of 5.0 mg DDE/kg)
0.05 mg DDE/kg wet wt = ATL in fish tissue considered protective of ospreys in the Willamette River (Henny et al. 2003.) based on a BMF or 87 and a NO- or LOAEL in osprey eggs of 4.2 mg/kg ww.
0.054 mg DDE/kg wet wt = CTL in fish estimated by DEQ Bioaccum Giuidance based on tthe National Recommended WQC of 0.001 ug/L and BCF of 54,000 l/kg.
0.051 DDE / kg wet wt = ATL is fish tissue (NOAEL) and 0.15 DDE / kg wet wt (LOAEL) estimated by DEQ Bioaccumulation guidance.
0.16 mg DDE/kg wet wt as level in fish that would have no effect on eagle eggs in the Great Lakes ; BMF of 22 and eagle egg NOAEC of 3.5 mg/kg ww (Giesy et al. 1995).

EGG APPROACH

Bird Egg TRVs, ATLs, and SLVs

BALD EAGLE

Chemical	Eagle Egg Individual TRV (mg/kg)	Eagle Egg Population TRV (mg/kg)	**Willamette River Osprey BMF study** Whole Body Fish to Osprey Egg	ATL OR PROTECTION LEVEL FOR PREY ITEMS: **In PPM wet wt** Eagle Individual ATL (TRV/BMF) in mg/kg	**In PPM wet wt** Eagle Population ATL (TRV/BMF) in mg/kg	**In PPB wet wt** Eagle Individual ATL (ug/kg)	**In PPB wet wt** Eagle Population ATL (ug/kg)	BSAF	EGG: Eagle Egg Individual SLV (ppm) dry wt	EGG: Eagle Egg Population SLV (ppm) dry wt
p,p'-DDE	2.2	6	87	0.03	0.07	25	69	4	0.70	1.9

OSPREY

Chemical	Osprey Egg Individual TRV (mg/kg)	Osprey Egg Population TRV (mg/kg)	**Willamette River Osprey BMF study** Whole Body Fish to Osprey Egg	ATL OR PROTECTION LEVEL FOR PREY ITEMS: **In PPM wet wt** Osprey Individual ATL (TRV/BMF) in mg/kg	**In PPM wet wt** Osprey Population ATL (TRV/BMF) in mg/kg	**In PPB wet wt** Osprey Individual ATL (ug/kg)	**In PPB wet wt** Osprey Population ATL (ug/kg)	BSAF	EGG: Osprey Egg Individual SLV (ppm) dry wt	EGG: Osprey Egg Population SLV (ppm) dry wt
p,p'-DDE	2	8.7	87	0.02	0.10	23	100	4	0.64	2.8

Data used and reported in EcoSSLs (data from EcoSSLs are apparently reporte

Surrogate Test Species	Chemical	EcoSSL Study Dose for NOAEL mg/kg WET WT	Eco SSL Study Dose for LOAEL mg/kg WET WT	Study Dose for NOAEL mg/kg DRY WT	Study Dose for LOAEL mg/kg DRY WT	Percent moisture in food	Ingestion Rate (IR) kg/day	Body Weight (BW) kg
Brwn Pelic	NR	NR	NR	NR	NR	NR	NR	NR
Kestrel	DDE	0.3	3	1.2	12.0	0.75	0.0139	0.111
Barn Owl	DDE		2.83		7.45	0.62	0.0403	0.568
Mallard	pp-DDE				10	dry feed	0.062	1.1
Mallard	DDE			1	5	dry feed?	0.062	1.1
Black duck	pp-DDE				10	dry feed	0.062	1.1
Mallard	pp-DDT			2	20	dry feed	0.131	1.32
Mallard	pp-DDT			10	40	NR	0.062	1.1
Chicken	ppDDT			5	50	NR	0.09248	2.0369

Notes:

The LOAEL value calculated by EcoSSL appears incorrect for unknown reason. Using the values supplied in the

Chicken NOAEL value selected to represent Avian TRV in EcoSSLs

Data used and reported by LWG in BERA (for DDE; for DDT they just used Eco

	Chemical	Study Dose for NOAEL mg/kg (WET wt)	Study Dose for LOAEL mg/kg (WET wt)	LWG Study Dose for NOAEL mg/kg DRY WT	LWG Study Dose for LOAEL mg/kg DRY WT	Fraction moisture in food	Ingestion Rate (IR) kg/day	Body Weight (BW) kg
Brwn Pelic	DDTresidu	NR	NR	NR	NR	NR	NR	NR
Kestrel	DDE			1.13	11.3	0.73	0.0136	0.13
Barn Owl	DDE		2.83		3.14	0.1	0.0539	0.524
Mallard	DDE		9			0.1	0.1082	1.082
Black duck	DDE		10			0.1	0.125	1.25
Mallard	DDT	NR	NR	NR	NR	NR	NR	NR
Mallard	pp-DDT	NR	NR	NR	NR	NR	NR	NR
Chicken	DDT	NR	NR	NR	NR	NR	NR	NR

Receptor-chemical evaluation not conducted by LWG (instead they used EcoSSL for DDT of 0.227 mg/kg-d)

Data used by DEQ and the Great Lakes Initiative as reported by EPA 1995

Surrogate Test Species	Chemical	Study Dose for NOAEL mg/kg	Study Dose for LOAEL mg/kg			Fraction moisture in food	Ingestion Rate (IR) kg/day WET WT unless otherwise noted	Body Weight (BW) kg
Brwn Pelic	DDTresidu	NR	0.15			0.75	0.62	3.5
Kestrel	DDE	0.3	3			0.75	0.37	0.12
Barn Owl	DDE	NR	NR			NR	NR	NR
Mallard	pp-DDT	2	20			NR	0.06	1
Mallard	DDE	NR	10			NR	0.06	1

Mallard	DDT	10	25	NR	0.06	1
Black duck	DDE	NR	10	0.1	0.058	1.1
Chicken	DDT	NR	10	NR	0.067	2

Note formula for calculation of NOAEL and LOAEL different because IR is in kg/kg-day rather than kg/day.

d as dry weight except for study dose)

Reported in EcoSSL: NOAEL mg/kg-day	Reported in EcoSSL: LOAEL mg/kg-day	**CHECK:** Wet Wt Test calculation for NOAEL (mg/kg-day)	**CHECK:** Wet Wt Test calculation for LOAEL (mg/kg-day)	**CHECK:** Dry Wt Test calculation for NOAEL (mg/kg-day)	**CHECK:** Dry Wt Test calculation for LOAEL (mg/kg-day)
NR	NR	NR	NR	NR	NR
0.04	0.40	0.04	0.38	0.15	1.50
NR	0.211	NR	0.201	NR	0.53
	0.56				0.56
0.06	0.28			0.06	0.28
	0.56				0.56
0.20	1.97			0.20	1.98
0.56	1.89			0.56	2.25
0.23	2.27			0.23	2.27

EcoSSL document, the correct value appears in "Check calculation" box.

SSL of 0.227 mg/kg-day)

NOAEL mg/kg-day	LOAEL mg/kg-day	Check: Test calculation for NOAEL (mg/kg-day)	Check: Test calculation for LOAEL (mg/kg-day)
NR	NR	NR	NR
0.12	1.2	0.12	1.2
	0.32		0.32
	0.90		0.90
	1.00		1.00
		NR	NR
		NR	NR
		NR	NR

NOAEL mg/kg-day	LOAEL mg/kg-day	Check: Test calculation for NOAEL (mg/kg-day)	Check: Test calculation for LOAEL (mg/kg-day)
NR	0.027	NR	0.027
0.11	1.1	0.11	1.11
NR	NR	NR	NR
0.12	1.2	0.12	1.20
NR	0.600	NR	0.60

0.6	1.500	0.600	1.50	
NR	0.580	NR	0.58	
NR	0.67	NR	0.67	

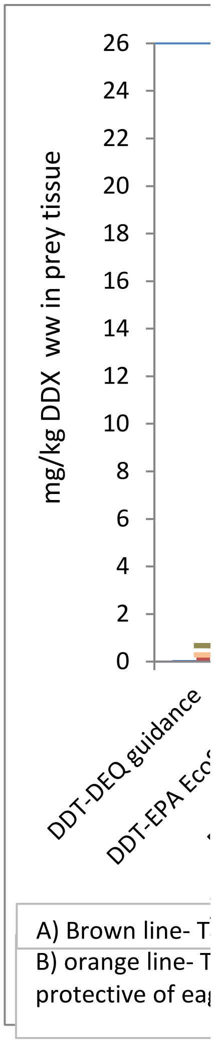
Endpoint	Ref
NR	NR
Eggshell thinning	Lincer 1975 (result 88 in EcoSSL)
Eggshell thinning	Mendenhall et al.1983 (result 137 in EcoSSL)
Reproductive success	Heath et al 1969 (result 150 in EcoSSL)
Eggshell thinning, Eggs	Carlisle et al. 1986 (result 89 in EcoSSL)
Eggshell thinning	Longcore et al. 1971 (result 147 in EcoSSL)
Eggshell thinning	Davison and Sell 1974 (result 92 in EcoSSL)
Reproductive success	Heath et al 1969 (result 94 in EcoSSL)
Growth	Cecil et al. 1978 (result 185 in EcoSSL)

	Ref
Eggshell thinning	Lincer 1975
Eggshell thinning, reduc	Mendenhall et al 1983
Eggshell thinning, crack	Heath et al 1969
Eggshell thinning, crack	Longcore et al. 1971
Reproductive success	Heath et al 1969
Eggshell thinning	Davison and Sell 1974
Reproductive effects in	Smith et al. 1970

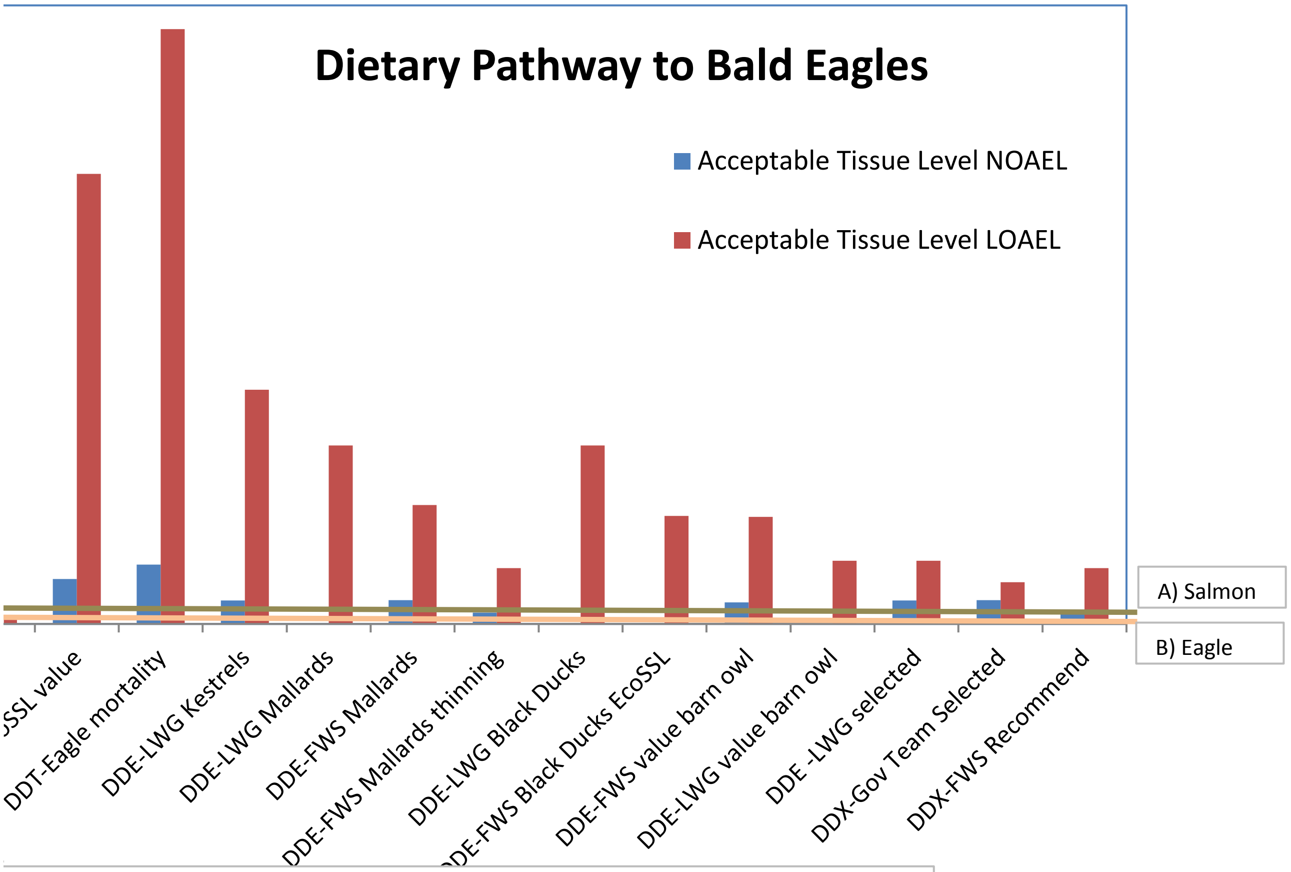
	Ref
Reproductive success, f	Anderson 1975
Eggshell thinning	Lincer 1975
NR	NR
Eggshell thinning	Davison and Sell 1974
Eggshell thinning, crack	Heath et al 1969

Reproductive success	Heath et al 1969
Eggshell thinning, crack	Longcore et al. 1971
Reproductive effects in :	Smith et al. 1970

Levels in Fish that Protect Bald Eagles	Acceptable Tis	Acceptable Tissue Level LOAEL
DDT-DEQ guidance	0.07	0.2
DDT-EPA EcoSSL value	1.89	19
DDT-Eagle mortality	2.50	25
DDE-LWG Kestrels	0.99	10
DDE-LWG Mallards		8
DDE-FWS Mallards	1.00	5
DDE-FWS Mallards thinning	0.47	2
DDE-LWG Black Ducks		8
DDE-FWS Black Ducks EcoSSL		5
DDE-FWS value barn owl	0.90	5
DDE-LWG value barn owl		3
DDE -LWG selected	0.99	3
DDX-Gov Team Selected	1.00	2
DDX-FWS Recommend	0.47	2

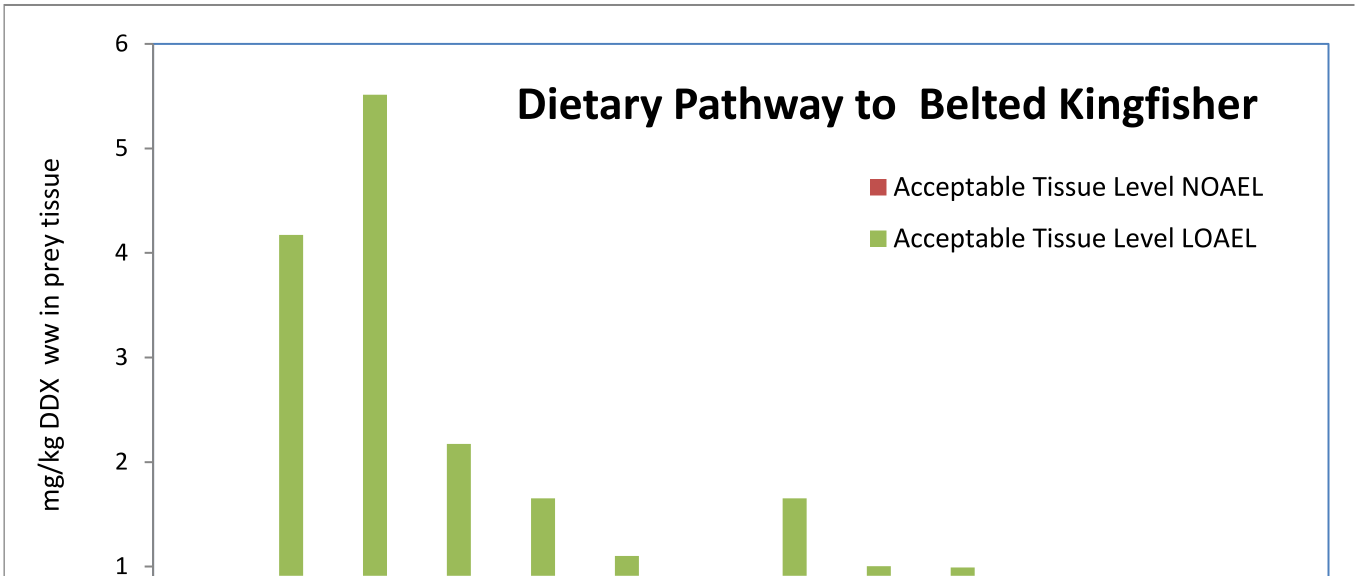


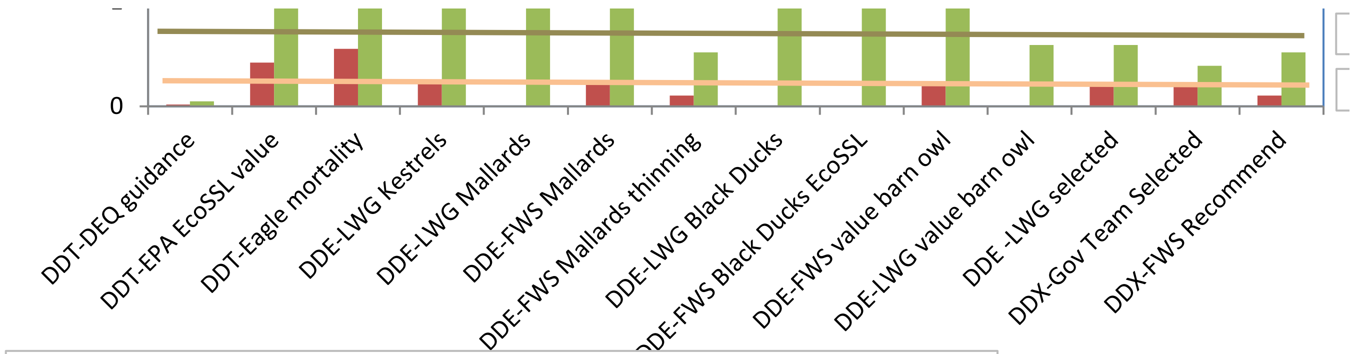
Levels in Fish that Protect Kingfisher	Acceptable Tis	Acceptable Tissue Level LOAEL
DDT-DEQ guidance	0.02	0.05
DDT-EPA EcoSSL value	0.42	4.17
DDT-Eagle mortality	0.55	5.51
DDE-LWG Kestrels	0.22	2.17
DDE-LWG Mallards		1.65
DDE-FWS Mallards	0.22	1.10
DDE-FWS Mallards thinning	0.10	0.52
DDE-LWG Black Ducks		1.65
DDE-FWS Black Ducks EcoSSL		1.00
DDE-FWS value barn owl	0.20	0.99
DDE-LWG value barn owl		0.59
DDE -LWG selected	0.22	0.59
DDX-Gov Team Selected	0.22	0.39
DDX-FWS Recommend	0.10	0.52



issue value of DDT (0.7) above which effects in juvenile salmon expected

issue value of DDE (0.16) in prey items of bald eagles considered protective in the Great Lakes (values considered gles and ospreys in this region are below this value.).





A) Brown line- Tissue value of DDT (0.7) above which effects in juvenile salmon

B) orange line- Tissue value of DDE (0.16) in prey items of bald eagles considered protective in the Great Lakes (values con protective of eagles and ospreys in this region are below this value.).

A) Salmon

B) Eagle

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